Semester 1 Examinations 2017 / 2018

Exam Code(s)	4BCT1, 4BP1
Exam(s)	B.Sc. Degree (Computer Science & Information Technology) Bachelor of Engineering (Electronic and Computer Engineering)
Module Code(s)	CT417
Module(s)	Software Engineering III
Paper No.	1
External Examiner(s)	Dr. Jacob Howe
Internal Examiner(s)	*Dr. Michael Schukat *Dr. Sam Redfern

Instructions: Answer question 1 (mandatory) and any 3 other questions.
Answer 4 questions in total.
All questions carry equal marks.

Duration	2hrs
No. of Pages	5 (Including cover page)
Department(s)	Information Technology
Requirements	None

Question 1 is mandatory

Q1. (20 marks)

Choose one of the following software architectures:

- Event-Driven Architecture
- Plug-in Architecture
- Cloud Architecture

For your chosen architecture:

(a) Briefly outline the key principles behind the architecture, using diagram(s) to assist your description.

5 Marks

(b) Discuss the key strengths and weaknesses of the architecture, referring to the following in your discussion: (i) Overall Agility; (ii) Ease of Deployment; (iii) Testability; (iv) Performance; (v) Scalability.

5 Marks

(c) Briefly describe one real-world application that would particularly suit implementation using the architecture. Clearly explain the reasons behind this choice.

5 Marks

(d) Discuss this same application with regards to one of the other architectures listed above, and explain why that other architecture would be a worse choice than your initially chosen architecture.

5 Marks

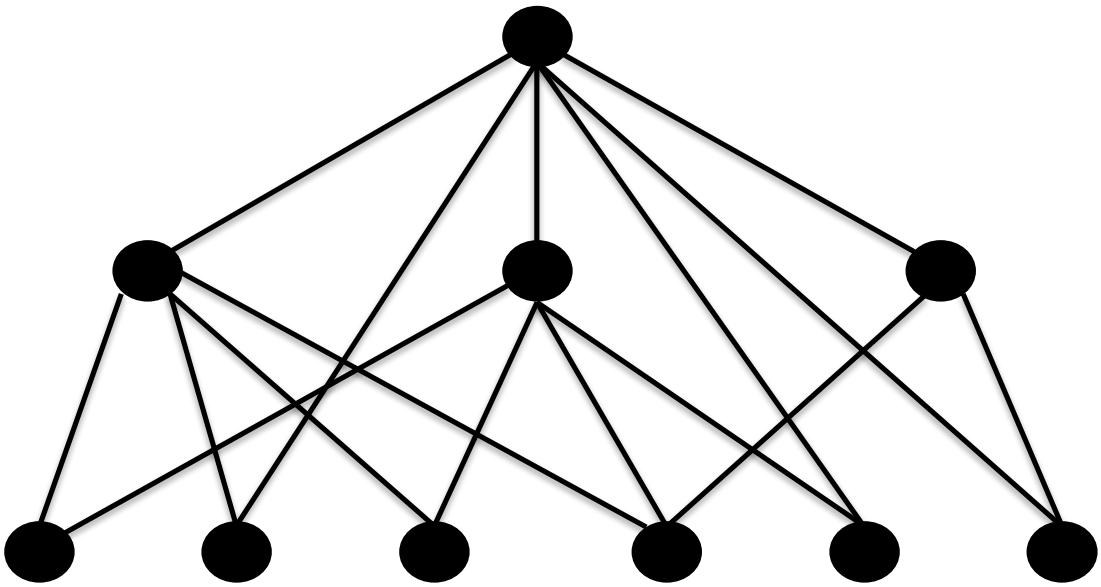
Q2. (20 marks)

(a) Identify the spanning tree for the following software module design, and calculate the values for Tree Impurity (m(G)) and Internal Reuse (r(G)).

Remember:

$$m(G) = \frac{number\ of\ edges\ more\ than\ the\ spanning\ tree}{maximal\ number\ of\ edges\ more\ than\ the\ spanning\ tree}$$

$$r(G) = number\ of\ edges\ additional\ to\ the\ spanning\ subtree$$



12 Marks

(b) Draw the following labelled flowgraphs:

- **D_2(D_2)**
- **D_0(D_0)**

Include the corresponding pseudocode for each of the program constructs.

8 Marks

Q3. (20 marks)

(a) What is meant by the *Response for a class* (RFC)?

Calculate the RFC for the class *classA* as shown below:

```
public class ClassA
{
  private ClassB classB = new ClassB();
  public void doSomething(){
    System.out.println ( "doSomething");
  }
  public void doSomethingBasedOnClassB(){
    System.out.println (classB.toString());
  }
}


public class ClassB
{
  private ClassA classA = new ClassA();
  public void doSomethingBasedOneClassA(){
    System.out.println (classA.toString());
  }

  public String toString(){
    return "classB";
  }
}
```

6 Marks

(b) Showing all workings, calculate the program *length* and *vocabulary* of the following code snippet:

```
int matchLocation(int[] a, int target)
{
    for(int i = 0; i  < a.length; i++)
    {
        if(a[i]==target)
            return i;
    }

    return -1;
}
```

10 Marks

(c) What is meant by the *volume* of a program and how is it calculated?

4 Marks

Q4. (20 marks)
(a) In measurement theory, distinguish between the 2 major scale types Ordinal and Ratio. Give an example measure for each scale.

3 Marks

(b) Describe, using examples, the following object-oriented measures:

- Number of operations overridden
- Depth of inheritance
- Coupling between objects

6 Marks

(c) Briefly summarise the *Jelinski-Moranda* (JM) model and argue why it is suitable as a model of software reliability growth. In your answer clearly show the formulation for the hazard rate.

3 Marks

Further on, assuming that the initial number of faults N in the system is 8, and φ = 0.005 (with φ being the contribution of each fault to the failure rate), predict the MTTF for the system after each of 6 successive system repairs.

8 Marks

Q5. (20 marks)
(a) Use the box plot method to identify outliers in the following data set for fault density (FD) in a range of software systems. Sketch the boxplot, showing the median, 1st and 3rd quartiles, upper and lower tails and the outliers:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
8	13	13	14	15	15	16	17	18	18	19	21	22	24	34	34	35	36

8 Marks

(b) Draw a flowgraph and prime decomposition tree for the following graph:

edges(1,2),(2,3),(3,2),(1,4),(2,5),(4,5),(5,6),(5,7),(6,7)

Briefly discuss how the resulting decomposition tree properties can provide useful information for software developers.

8 Marks

(c) What is meant by the *Halstead Complexity Measure* (HCM)?

4 Marks